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AEROSOL DISINFECTION OF LIVESTOCK QUARTERS DURING BRUCELLOSIS

by

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AEROSOL DISINFECTION OF LIVESTOCK QUARTERS DURING BRUCELLOSIS

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In the complex of anti-brucellosis preventive measures a great deal of attention is paid to veterinary sanitation measures. Because causitive agents of infection accumulate after animals are held inside livestock quarters for a long period, one of the indispensable conditions is periodic disinfection. The increased moisture in the livestock quarters promotes the survival of brucella and preserves their virulence. All this creates suitable conditions for infection of animals and a breakdown of immunity in vaccinated animals. When brucellosis is present disinfection is carried out after each routine blood test, when the animals abort, and in brucellosis isolation quarters every month. Delivery sections on farms which are unsafe with respect to brucellosis must also be disinfected after each calving.

At present time a large number of effective agents for wet disinfection are available. Reliable disinfection is accomplished with application of at least 1 l of disinfecting solution per 1 m^2 of treated surface. However, the process of wet disinfection requires a great deal of labor in preparing and spraying the disinfectants; excessive wetting with solutions of chemical preparations causes damage to the buildings and equipment.

The indicated shortcomings of wet disinfection compel us to look for new methods of disinfecting livestock quarters. In this respect, the aerosol method of disinfection, during which the solution of disinfecting substances is atomized into a fog-like state, merits a great deal of attention. The aerosol particles penetrate into all the inaccessible places of the building. Some of the aerosol drops evaporate and act on the infected surfaces in the vapor state. Everything in the building and also the air are subjected to the disinfecting action; this has a significant role in the fight against airborne infections.

The literature contains a whole series of reports by Soviet and foreign scientists on using aerosols of chemical substances for air and surface disinfection. Many chemical substances were tested but primarily only formaldehyde-containing preparations turned out to be effective for aerosol disinfection of the buildings. At present methods have been developed for aerosol disinfection of poultry barns which are unsafe with respect to pasteurellosis, pullorosis, tuberculosis, pseudoplague, fowl-pox, respiratory mycoplasmosis, and other diseases.

However, the experiments were carried out mainly in various aerosol chambers and also chicken factories, which had a good hermetic sealing and high ambient medium temperature.

In the available literature we did not find any data on investigations of aerosol disinfection regimes during brucellosis. Taking this into account, we set up experiments for developing methods of aerosol disinfection for this infection. Beforehand, we investigated the disinfection of various test objects infected with the causative agent of brucellosis, using a box 13 m^3 in volume. With the expenditure of 8-12 ml of formalin per 1 m^3 and exposure for 1 h, test objects made of wood and coarse calico were completely disinfected.

A VDM machine which was mounted on the chassis of a GAZ-69 automobile and equipped to carry out wet and aerosol disinfections

was used. In the sovkhoz "Perevalovo" wooden buildings of various dimensions were subjected to aerosol decontamination: cow barn – 1000 m^3, calf pens – 800, 480, and 420 m^3, and stables – 480 m^3. In the sovkhoz "Plodovyy" experiments were carried out in the typical brick livestock quarters: a four-row cow barn – 5120 m^3, a cow barn – 3800 m^3, calf pen with calving section – 1320, isolation quarters – 505, and milking parlors – 365 and 220 m^3. Before aerosol disinfection, the doors and ventilation openings were closed and broken window panes were replaced; small door and window cracks were not sealed.

We used wooden test objects, 20 × 20 cm in size, which were infected with a mixture of two-billion suspensions of agar cultures of strain No. 19 and local strains of Br. abortis bovis. The infection density was 30 million microbes per 1 cm^3. Sterile and unsterile dung in the amount of 0.6 g per 100 cm^3 was used to contaminate the test surfaces.

The infected test objects, 8-14 pieces, were placed in different places in the building: under a feeding trough, along the walls, on the floor and ceiling. After disinfection the wooden surfaces were scraped with a scalpel and after appropriate preparation the scrapings were planted on solid and liquid nutrient media – MPPA [beef-extract liver agar] and MPPB [beef-extract liver broth]; in addition to this, a biological test was performed on guinea pigs. The laboratory animals were observed for 40-50 days. Every 10-12 days they were checked by the agglutination reaction (RA) which was done on serum dilutions from 1:5 to 1:320. After the observation period the guinea pigs were anesthesized with ether; then cultures of internal organs were taken and planted on MPPA and MPPB. The positive results of disinfection were evaluated on the basis of absence of brucella growth on nutrient media and negative biological test data.

The disinfecting aerosol was introduced through hinged ventilating panes of the windows from one, two, or three places, depending on the cubic volume of the building and the presence of partitions. For disinfection a 50% formalin solution (20% solution of formaldehyde)

and also a mixture consisting of 20% formaldehyde (4 parts) and xylonaphtha (1 part) were used.

Formaldehyde in storage, even at room temperature, is subject to polymerization, and when formalin in glass jugs is stored in a cold place, a considerable amount of the formaldehyde precipitates in the form of white sediment of paraformaldehyde. In practice it is difficult to use this sediment for aerosol disinfection. Depolymerization of the formaldehyde was accomplished by addition of an equal amount of hot water (90°) to the sediment and a thorough mixing. The formalin solution, containing 20% formaldehyde, was filtered through a double layer of gauze and used for aerosol disinfection. The dose of the disinfecting solution was 10-22 ml per 1 m^3 of the premises. The experiments were carried out in the summer at 20-26° temperatures and 83-91% relative humidity. In all, 12 livestock buildings totaling 19,600 m^3 were subjected to disinfection.

As a result of the experiments it was established that livestock quarters with volumes up to 600 m^3 can be disinfected by a 20% aerosol solution of formaldehyde in the amount of 10-20 ml per 1 m^3 and exposure time of 3-4 h. The aerosol was introduced from one place, the middle of the building, with the spray jet directed in different directions. The duration of the aerosol spraying was 15-18 min.

The aerosol was sprayed into buildings with dimensions of 800, 1000, and 1321 m^3 from two places. Disinfection was very effective; the guinea pigs (biological test) did not get sick and brucella cultures on MPPA and MPPB did not show any growth.

Dairy barns with dimensions of 3800 and 5120 m^3 were disinfected with 20% aerosol solution of formaldehyde in a quantity of 20-22 ml per 1 m^3 of the building and an exposure time of 4 h. The aerosol was introduced from three places.

Complete disinfection of a four-row cattle barn was not achieved with aerosol of formalin-xylonaphtha mixture dispensed in the amount

of 20 ml per 1 m^3 and exposure time of 3 h. During the biological test all three guinea pigs came down with brucellosis.

In the sovkhoz "Plodovyi" the cows are milked with milking machines of the "elochka" ["little spruce"] in two special parlors. The milking parlors are standard, airtightness is good, and the floors are cement. The milking parlors were disinfected after morning milking. Aerosol was introduced through the ventilating pane of the window for a period of 10-12 min. After 2.5-3 h of exposure the building was thoroughly aired. Reliable disinfection of the milking parlors was achieved with 18-20 ml of disinfectant solution per 1 m^3.

Carrying out disinfection in the summer during the brucellosis period must be done along with disinfestation; for this reason, we studied the possibility of using the aerosol method for simultaneous disinfection and disinfestation. For this purpose khlorofos* was added to the formalin solution in the amount of 0.5 g per 1 m^3 of room area being sprayed. In the course of 3 h. The aerosol of insecticide-bactericide preparation caused 100% mortality of flies in the sprayed buildings.

Conclusions

1. Summertime disinfection of livestock quarters infected with the causative agent of brucellosis is achieved with 20% aerosol solution of formaldehyde in the amount of 15-22 ml per 1 m^3 and exposure time of 3-4 h. Addition of khlorofos to the formaldehyde in the amount of 0.5 g per 1 m^3 eliminates flies and disinfects the quarters at the same time.

2. Enclosed milking parlors with dimensions of up to 500 m^3 are decontaminated with a 20% aerosol solution of formaldehyde in the amount of 18-20 ml per 1 m^3 with 2.5-3 h exposure time.

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*Khlorofos - trichlorfon.

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ABSTRACT

(UNCL, 0) ABSTRACT OF REPORT. Study and experiments were carried out on disinfection and prevention of brucellosis in live stock quarters using formaldehyde as a basic chemical which gave satisfactory results.